

Medication errors: the importance of an accurate drug history

Richard J. FitzGerald

Department of Pharmacology and Therapeutics, University of Liverpool, Liverpool, UK

Correspondence

Dr Richard J. FitzGerald, Department of Pharmacology and Therapeutics, University of Liverpool, Ashton Street, Liverpool, L69 3GE.
Tel: 0151 794 5557
Fax: 0151 794 5540
E-mail: richard.fitzgerald@liverpool.ac.uk

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1. Medication histories are important in preventing prescription errors and consequent risks to patients. Apart from preventing prescription errors, accurate medication histories are also useful in detecting drug-related pathology or changes in clinical signs that may be the result of drug therapy. A good medication history should encompass all currently and recently prescribed drugs, previous adverse drug reactions including hypersensitivity reactions, any over-the counter medications, including herbal or alternative medicines, and adherence to therapy.
2. Medication history errors, such as omitting drugs erroneously, are common and often have the potential to harm the patient. Hypersensitivity reactions are often poorly documented or not explored in detail, which may lead to unnecessary avoidance of a drug. Accurate documentation of concomitant herbal or alternative therapies is rare, despite the importance they may have in causing adverse effects or drug-drug interactions. Polypharmacy, specific drugs, and clinical specialty can affect the risk of medication history errors.
3. There are various strategies to reduce medication history errors. Pharmacists are better at taking an accurate medication history than many physicians or nurses. In the context of acute hospital admissions they reduce error, the risks of adverse drug reactions, and prescription costs. Electronic prescribing may reduce transcription errors, but it can facilitate other errors and still depends on an accurate medication history.
4. Education of prescribers, both in clinical pharmacology and in taking accurate medication histories is vitally important in reducing errors.

Over two and a half million prescriptions are written every day in the UK's National Health Service, and in a UK hospital of average size around 7000 medications will be administered daily [1]. Error is possible in any part of the medication process – prescribing, transcription, dispensing, administration, or monitoring – but it is in the prescribing phase that errors in the medication history may have their effect.

Prescribing faults

Prescribing faults affect up to 11% of prescriptions, with a cost of around £400 million per year (the annual cost of running four district general hospitals) [1]. Around 16% of prescribing faults resulted in harm to patients; for example, between January 2005 and June 2006 there were 38 deaths in the UK that resulted direct from prescribing faults.¹ Most of these errors were preventable: for example, drugs administered despite a contraindication, drugs given by an incorrect route, drugs given in an inappropriate dose, or drugs given with inadequate monitoring.

The medication history

There are several reasons for taking an accurate medication history [2]:

- A knowledge of the drugs a patient has taken in the past or is currently taking and of the responses to those drugs will help in planning future treatment.
- Drug effects should always be on the list of differential diagnoses, since drugs can cause illness or disease, either directly or as a result of an interaction.
- Drugs can mask clinical signs. For example, β -adrenoceptor antagonists can prevent tachycardia in a patient with haemorrhage, and corticosteroids can prevent abdominal pain and rigidity in a patient with a perforated duodenal ulcer.
- Drugs can alter the results of investigations. For example, amiodarone alters thyroid function tests.
- To take the opportunity to educate the patient about their medications.
- To help avoid preventable errors in prescribing, since an inaccurate history on admission to hospital may lead to

unwanted duplication of drugs, drug interactions, discontinuation of long-term medications, and failure to detect drug-related problems [3].

Other aspects of the medical history and examination may also be important in preventing a prescribing fault. For example, a history of chronic renal insufficiency will highlight the need for caution when introducing an angiotensin converting enzyme inhibitor. Furthermore, the effects of some drugs can be detected by examination, such as the beneficial effect of salbutamol on the peak expiratory flow rate or the adverse effects of phenytoin on the central nervous system (nystagmus and ataxia).

Errors are more common on admission to hospital for many reasons: patients often are not able to report their drug history accurately and may not bring either the drugs themselves or even a recent list of medications with them [3–5]. A drug prescribed in error will often not be checked until a pharmacist reviews the patient's prescription, which may not be for up to 72 h after admission. Clearly, therefore, the medication history must be accurate at the time of admission and should be checked at the earliest opportunity during a patient's hospital stay.

The medication history should not simply be a list of a patient's drugs and dosages. Other information, such as adherence to therapy and previous hypersensitivity reactions and adverse effects, should be noted and should be compared with the patient's general practitioner (GP) records or previous prescription history in their hospital case notes. Adverse drug reactions are often poorly recorded; of 117 patients, 50 had had a total of 81 previous adverse reactions, but only 75% were recorded on medication charts and 57% and 64% in the medical and nursing notes, respectively [6].

Herbal remedies are infrequently recorded but may be important causes of morbidity. Constable *et al.* described a 77-year-old woman taking lansoprazole in whom induction of CYP2C19 by St John's wort (reducing the effect of lansoprazole) plus inhibition of platelet aggregation by ginseng led to upper gastrointestinal haemorrhage [7]. Neither of these herbal medications was listed on the admission drug history, but they were both important in the presentation and had implications for the prevention of further episodes. In an audit conducted by the same authors, only one person out of 24 taking herbal medications had this documented in the case notes.

Indeed, all forms of complementary and alternative medicine (CAM) are poorly recorded. In one study, 59 of 101 patients used 129 forms of CAM in the month before admission, but only 36 were documented in the medical records [8].

The details that should be elicited in a good medication history are described below.

History from the patient

When taking the history from the patient use the words 'medicines' or 'medications', rather than 'drugs', which may be mistaken for drugs of abuse or recreational drugs. Elicit the following information:

- 1 Current prescribed drugs, formulations (e.g. modified-release tablets), doses, routes of administration (e.g. oral, transdermal, by inhalation), frequencies, duration of treatment.
- 2 Other medications (e.g. over-the-counter drugs and herbal or natural remedies, such as vitamins and glucosamine).
- 3 Drugs that have been taken in the recent past (important for drugs with long half-lives, such as amiodarone).
- 4 Previous drug hypersensitivity reactions, their nature and time course (e.g. a rash, anaphylaxis).
- 5 Previous adverse drug reactions, their nature and time course (e.g. nausea with erythromycin, peripheral oedema with amlodipine).
- 6 Adherence to therapy (e.g. 'are you taking your medication regularly?'), recognizing that the information may be inaccurate.

History from the GP or community pharmacist

- 1 Up-to-date list of medications.
- 2 Previous adverse drug reactions.
- 3 Last order dates for each medication.

History from case notes

- 1 Previous prescriptions.
- 2 Previous adverse drug reactions.

Inspection

Drugs and their containers (for example, packs, bottles, vials) should be inspected for name, dosage, and the number of dosage forms taken since dispensed; it is often possible to identify a medicine by inspecting the formulation.

Medication history errors: the scale of the problem, consequences, and prediction

Errors in the medication history can be classified into omission errors (drugs missed from the history), commission errors (drugs added to the history), frequency errors, and dose errors. Lau *et al.* showed that up to 67% of patients had at least one medication error on admission to hospital general medicine wards [3]. Most were omission errors, but this study did not consider errors in dose or frequency as medication errors and so probably underreported the frequency of errors. In addition, there was no measure of the

potential severity of the outcome of the error. A more recent systematic review of 22 individual studies showed that 10–61% of patients had at least one omission error and 13–22% had at least one commission error in their history; 41% of all errors were clinically important and 22% had the potential to cause harm during the patient's admission [9]. However, a number of studies included in the review did not consider dose or frequency errors; this may explain the wide range of estimates for medication history errors reported in the systematic review. Furthermore, most studies do not differentiate between what is a deliberate change in medication for therapeutic reasons and what is an unintended medication change, making assessment of error a challenging task. It is also difficult to quantify the effects of medication history errors on patients (i.e. did they cause harm?), because sample sizes are small (often <100 participants) and potential severity is not elucidated. This variability in reporting methods for medication history errors and poor study quality make establishing the extent of the problem difficult, although it is clear that there is potential for significant harm to patients. This is particularly true when the type of drug most commonly involved in medication history errors is considered: often these are drugs that have the potential for severe adverse effects and may have narrow therapeutic windows (e.g. digoxin). Cardiovascular drugs, sedatives, antibiotics, antithrombotic drugs, and analgesics were the most frequently involved in medication history errors [9–11], and given the potential for adverse effects from these drugs it is hardly surprising that in one study 59% of medication history errors would have resulted in potential harm if they had been continued beyond hospital discharge [12]. Cornish *et al.* reported that 39% of recorded errors had the potential to cause moderate or severe harm to patients in their study of 151 patients [13]. Examples included continued use of diclofenac in patients with upper gastrointestinal bleeding and the omission of a regular corticosteroid (prednisolone 7.5 mg day⁻¹) in a patient with acute confusion. There were no significant correlations between the time of admission (night-time, weekend) or polypharmacy and the mean error rate per patient.

Previous hypersensitivity reactions may be documented without being explored in detail [14]. For example, a history of 'allergy to penicillin' may not represent true hypersensitivity and may lead to unnecessary avoidance of a penicillin both currently and in the future. In one case, a patient thought that he was allergic to penicillin because he had developed facial folliculitis 1 month after a course of ampicillin; he was given flucloxacillin for cellulitis without mishap.

Some adverse effects (e.g. peripheral oedema with amlodipine or a transient rise in liver function tests after starting rifampicin) need not preclude use of the drug in the future. This is especially important in chronic conditions such as hypertension, in which multiple adverse effects are more common [15].

Risk factors for errors in the medication history

Polypharmacy is a logical candidate as a risk factor for errors in transcribing drugs, but the evidence is contradictory [13, 16, 17]. Specific drugs, such as anticoagulants, cardiovascular drugs, nonsteroidal anti-inflammatory drugs, opioids and corticosteroids, and modified-release formulations, are more likely to be subject to errors, although this may simply represent their widespread use and multiple formulations. Cornish *et al.* found no correlation between the time of admission and the rate of errors, but Picone *et al.* found that staffing changeover times were associated with a higher incidence of errors [16]. Finally, the clinical specialty alters the recording of a medication history: cardiologists and respiratory physicians reportedly take the most detailed histories [18].

Preventing medication errors from inadequate medication histories

There are various strategies for reducing the impact of errors in the medication history (such as a more involved role for pharmacists) and for preventing errors in the subsequent transcription of the medication history (better education for prescribers).

Pharmacists have been involved with medication reconciliation for several years. In the context of acute general (internal) medicine admissions, pharmacists obtain better medication histories than many physicians and also identify more medication doses and frequencies [19]. These findings are similar to those of Carter *et al.*, who showed similar improvements in medication histories and documentation of allergies by pharmacists in Emergency Departments compared with physicians and nurses [20]. There are also reductions in medication errors when pharmacists are involved in pre-admission clinics for elective surgery: in a recent study, of the histories taken by pharmacists 13% contained a medication error with the potential to cause harm, compared with 30% in the standard care group (histories taken by physicians and nurses) [21]. Clearly, there is benefit from using pharmacists in acute or elective admission processes, but doing so is expensive and time-consuming and may not be cost-effective. An alternative, particularly in UK hospitals, would be to have a pharmacist attend the post-take ward round. Fertleman *et al.* found that pharmacists identified and resolved more medication history errors and that mean increases in the costs of medications between admission and discharge were reduced (£181 before intervention vs. £122 after, a 33% reduction) [22]; they proposed that having a pharmacist present when prescribing decisions were made would have a significant impact on medication safety and costs in UK district general hospitals.

Electronic prescribing may also have a role in preventing medication history errors. Electronic prescribing still depends on an accurate and complete medication history,

but it will prevent some serious transcription errors (for example, prescribing methotrexate once a day rather than once a week). Electronic prescribing may alter prescribing behaviour; in one study there was a marked improvement in prescribing behaviour by junior doctors over a 3-week period, as measured by the number of warning messages generated by the electronic prescribing system [23]. As a whole, medication errors are reduced by electronic prescribing [24, 25], but they can also facilitate errors [26]. Drop-down boxes in response to predictive text are a common feature of electronic prescribing systems and can lead to the selection of an unintended drug (e.g. amiodarone instead of amoxicillin). Similar drug names and differing proprietary names of long-acting formulations are as much a problem with electronic prescribing as with paper prescribing [27]. Electronic prescribing reduces error, but does not remove the necessity of a through medication history.

Education of prescribers is currently under review in the UK, and the draft version of the forthcoming edition of *Tomorrow's Doctors*, the document in which the General Medical Council details the abilities that are expected of newly qualified doctors, now for the first time contains details about prescribing [28]. However, there is a lack of clinical pharmacologists for teaching undergraduates [29] and while this is so, formal teaching of therapeutics, which is currently patchy, is unlikely to improve. Furthermore, there is currently no standardized assessment of prescribing competence, for either undergraduates or postgraduates [30].

Education of prescribers in basic and clinical pharmacology is key in preventing errors in the medication history and other medication errors. For example, when doctors were educated about the need to take a history of the use of complementary and alternative medicines and of previous adverse drug reactions, there were significant improvements in the recording of these details [6, 8]. In addition, the concept of harm from unintended medication errors needs to be emphasized to all prescribers. Without this, errors will continue to occur and patients will suffer harm.

Conclusion

Medication errors are common and can significantly harm patients. An important component is the medication history, which is often incomplete and inaccurate. Current studies suggest that this is a common and worldwide problem, but the results are limited by small numbers, differing measures, and poor assessment of consequences. Pharmacists can play an important role in preventing unintended errors, by being involved in obtaining medication histories during acute admissions or on post-take ward rounds. Electronic prescribing is not a substitute for an accurate medication history, although it may prevent some

errors associated with transcription of medications. Finally, education of prescribers is vital to emphasize the importance of accurate medication histories and the clear potential for harm from unintended discrepancies.

Competing interests

None to declare.

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